

WHAT IS CLAIMED IS:

CLAIMS

1. A fixation device for fixing a fracture in a bone structure, said fixation device comprising:

a bendable fixation pin adapted for penetrating through an unstable bone fragment of a bone structure across a fracture and into a stable bone fragment of said bone structure, said pin having an end extending out from said unstable bone fragment,

a fixation plate adapted for being secured to the stable bone fragment at a distance from said end of said fixation pin,

said fixation plate being engageable with said end of said bendable pin to prevent said pin from backing out of the bone structure while providing restraint against movement of said pin in the plane of the plate.

2. The fixation device as claimed in claim 1, wherein said fixation plate has a lower surface with a groove therein to engage said end of the fixation pin and prevent backing out of said pin from the unstable bone fragment.

3. The fixation device as claimed in claim 1, wherein said end of said fixation pin includes a bent portion which is engaged by said fixation plate to prevent said pin from backing out of the unstable bone fragment while providing restraint against movement of said pin in the plane of the plate.

4. The fixation device as claimed in claim 3, wherein said fixation plate includes means for engaging said bent portion of said fixation pin.

5. The fixation device as claimed in claim 4, wherein said means for engaging said bent portion of said fixation pin is constituted by a lower surface of said fixation plate which bears against said bent portion of said fixation pin to restrain said pin with respect to the bone structure.

6. The fixation device as claimed in claim 4, wherein said means for engaging said bent portion of said fixation pin comprises a groove in said plate for receiving said bent portion of said pin.

7. The fixation device as claimed in claim 6, wherein said fixation plate has an undersurface for facing the bone structure, said groove being provided in said undersurface of said fixation plate.

8. The fixation device as claimed in claim 3, wherein said bent portion of said pin is bent longitudinally of said fixation plate.

9. The fixation device as claimed in claim 3, wherein said bent portion of said pin is bent transversely of said fixation plate.

10. The fixation device as claimed in claim 4, wherein said groove in said

fixation plate has a side opening to permit the bent portion of said pin to protrude therefrom.

11. The fixation device as claimed in claim 3, wherein said bent portion of said pin has a U-shape, said fixation plate having an outer surface with a groove in which said bent portion of U-shape is gripped.

12. The fixation device as claimed in claim 4, wherein said fixation plate has an end and said means on said fixation plate comprises two tabs extending longitudinally at said end in transversely spaced relation, said tabs facing one another to engage said bent portion of the pin from above and below.

13. The fixation device as claimed in claim 12, wherein said tabs are at different levels at said end of the fixation plate.

14. The fixation device as claimed in claim 12, wherein said tabs are at the same level at said end of the fixation plate and said bent portion of said pin is bent to pass between said tabs.

15. The fixation device as claimed in claim 6, wherein said fixation plate has an end, said groove extending longitudinally in said fixation plate and being open at said end of said fixation plate.

16. The fixation device as claimed in claim 15, wherein said bent portion of

said fixation pin is bent at a second bend to form a second bent portion, said fixation plate having a hole through which said second bent portion of said pin can extend.

17. The fixation device as claimed in claim 3, wherein said fixation plate has an end with a groove therein, said groove having a V-shape in a longitudinal direction of the fixation plate and narrowing in a direction from an undersurface of said fixation plate to an outer surface of said fixation plate.

18. The fixation device as claimed in claim 6, comprising a barb on said pin to engage said fixation plate when said pin is received in said groove.

19. The fixation device as claimed in claim 1, wherein said pin has a smooth end for penetrating into said stable bone fragment.

20. The fixation device as claimed in claim 1, wherein said pin has a threaded end for threaded engaging in said stable bone fragment.

21. The fixation device as claimed in claim 6, wherein said bent portion of said fixation pin has a length for extending a distance from its entry site into the unstable bone fragment, said groove in said fixation plate receiving said bent portion of said pin.

22. The fixation device as claimed in claim 3, wherein said angle at which said bent portion of said end of said fixation pin extends is such that said bent portion will lie

substantially parallel to said bone structure.

23. The fixation device as claimed in claim 1, wherein said fixation plate is crimped against said end of the pin to be deformingly and clampingly engaged therewith.

24. The fixation device as claimed in claim 23, wherein said end of the pin passes in a bore in said fixation plate and said fixation plate is crimped at said bore.

25. The fixation device as claimed in claim 23, wherein said fixation plate has longitudinally extending tabs at an end of said fixation plate defining a groove in which said end of the pin extends, said tabs being crimped to engage said end of the pin.

26. The fixation device as claimed in claim 25, wherein two said tabs are disposed one above the other at one side of the pin and a further said tab is disposed at an opposite side of the end of the pin.

27. The fixation device as claimed in claim 26, wherein said further tab is at a level between said two tabs disposed one above the other.

28. The fixation device as claimed in claim 1, wherein said fixation plate has a hole in which said pin extends, said pin having an end which is cut in proximity to a top surface of the plate and is welded to said plate thereat.

29. A method of fixing a fracture in a bone structure, said method comprising:

inserting a fixation pin into stable fragment of a bone structure across a fracture and leaving an end of the pin extending from an unstable fragment of the bone structure,

securing a fixation plate to said bone structure at a distance from the extending end of said fixation pin,

providing said end of said fixation pin with a bent portion extending at an angle with respect to an axis of the pin so that the bent portion extends parallel to the bone structure, and

engaging said fixation plate with said bent portion of said pin to prevent said pin from backing out of the bone structure while providing restraint against movement of said pin in the plane of the plate.

30. A method of fixing a fracture in a bone structure said method comprising:

inserting a fixation pin into stable fragment of a bone structure across a fracture and leaving an end of the pin extending from an unstable fragment of the bone structure,

inserting the end of the pin through a hole in a fixation plate,

securing the fixation plate to said bone structure at a distance from the extending end of said fixation pin,

cutting said end of said fixation pin in proximity to a top surface of the fixation plate, and

welding said end of the fixation pin and said fixation plate together to prevent said pin from backing out of the bone structure while providing restraint against movement of said pin in the plane of the plate.

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